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WISSENSCHAFTLICHE KURZMITTEILUNGEN

Is dominance an absolute quality in male Tree shrews *(Tupaia belangeri)*?

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There is always a good chance that one can predict the results of dominance fighting in animals: The stronger individual will be the winner or, if the opponents are comparable in strength, the owner of the territory will win. The question remains to be answered what will happen in experiments in the laboratory, where the opponents are of comparable physical and/or physio-psychological strength and do not have a territory? In the context of physiobehavioral studies in tree shrews, often the question has been rised concerning the consequences of confrontation of two formerly dominant males. To study this situation, we designed a confrontation experiment and analysed the behavior of two males which had proved themselves dominant in former experiments. It is unknown, whether dominance in tree shrews under laboratory conditions is an absolute or relative quality. If it is a relative quality, a hierarchy system should be established between the two animals, and in this situation we would receive the first quantitative description of behavior in subordinate tree shrews.

The behavior of two adult male tree shrews (♂ 525, ♂ 447), which both had reached dominant positions in former confrontation experiments (Aue and Fuchs 1986) was recorded on video tapes on three days over a period of one month during the first three hours of the light phase of an artificial L:D (08.00–20.00 hr). To avoid a territorial advantage for either one of the animals, they were placed together in a cage, which was new for both of them and which was equipped like their home cages. After putting the animals together, behavior was again recorded during the first three hours after beginning of the light phase on confrontation days 1, 2, 3, and 10. On day 19, when both animals were back in their home cages after the seventeen day confrontation period, the behavior of both animals was monitored. The body weight of each animal was recorded daily before, during,

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and after confrontation. Quantification of behavior was carried out as described earlier (Aue and Fuchs 1986). The analysis takes into account thirty-five defined variables (according to Richards 1976) from the categories "locomotion", "comfort activities" (cleaning movements and self-rubbing), "investigative behavior", "behavior related to metabolism", "territorial behavior" and "aggressive behavior", in their temporal and spatial distribution. A total of 24 observation hours provided more than 130,000 information units. For the statistical evaluation, the wilcoxon, Matched-Pairs-Signed-Rank-Test, one or two tailed, was used if not otherwise noted.

Body weight: During confrontation, ♂ 525 had a more or less stable body weight (260 ± 7.1 g, n = 16), whereas ♂ 447 showed a weight loss from 210 g to 179.6 ± 4.3 g (n = 16) which characterizes this animal as being subordinate.

Aggressive interactions: During day 1 of confrontation ♂ 447 initiated more aggressive actions although he became subordinate during the experiment. On day 2, there was a total lack of aggressive interactions between the two animals. On the days 3 and 10, ♂ 525 clearly dominated in attacking and hunting the opponent.

Marking behavior: The results of marking behavior for both animals before, during, and after confrontation are summarized in Fig. 1. ♂ 525 showed a significant increase of sternal ($p<0.05$, one tailed) and abdominal ($p<0.05$, two tailed) marking on day 1 of confrontation and a remaining significant increase of abdominal marking ($p<0.05$, one tailed) on the following days 2 and 3. On day 10 of confrontation and on day 19 after its end, there were no significant differences in marking behavior as compared to control values. ♂ 447 decreased his sternal marking activity significantly on days 2, 3, and 10 ($p<0.05$, two tailed), as well as abdominal marking on day 3. On day 19 after the end of the confrontation, ♂ 447 returned to his normal marking behavior.

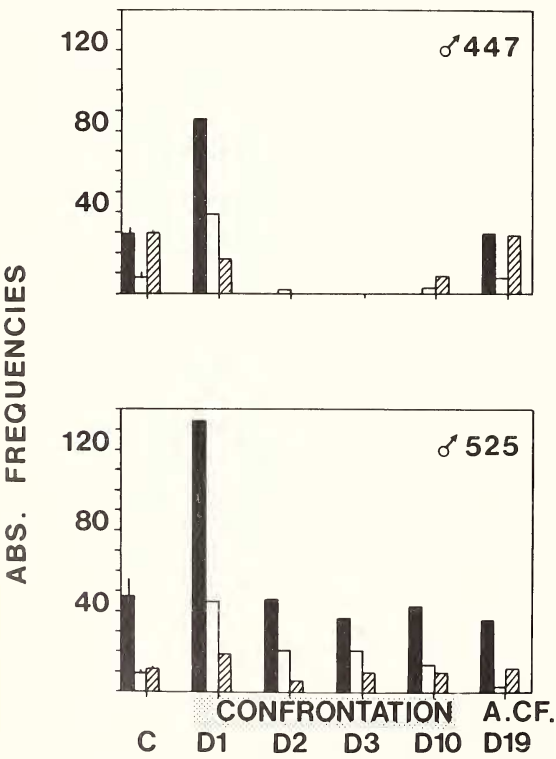

Fig. 1. Marking behavior (absolute frequencies) of ♂ 447 and ♂ 525 during the control situation (C: $\bar{x}$ ± SD, n = 3), on the days 1, 2, 3, and 10 of confrontation and on day 19 after its end (A. CF.), ■ sternal, □ abdominal, ▥ urine marking

General motor activity (GMA): The GMA describes the total motor activity level of an animal and is composed of the frequencies of the various variables of behavior shown per 15 minute interval.

Compared to the control values, ♂ 525 showed a significant increase ($p<0.05$, one tailed) in the GMA on day 1 of confrontation but no significant changes on days 2, 3, 10, and on day 19 after the end of the confrontation (Fig. 2). In contrast, ♂ 447 decreased his GMA on days 2 and 3 significantly ($p<0.05$, two tailed).

Comfort activities: Compared to the control situation ♂ 525 showed no significant changes in

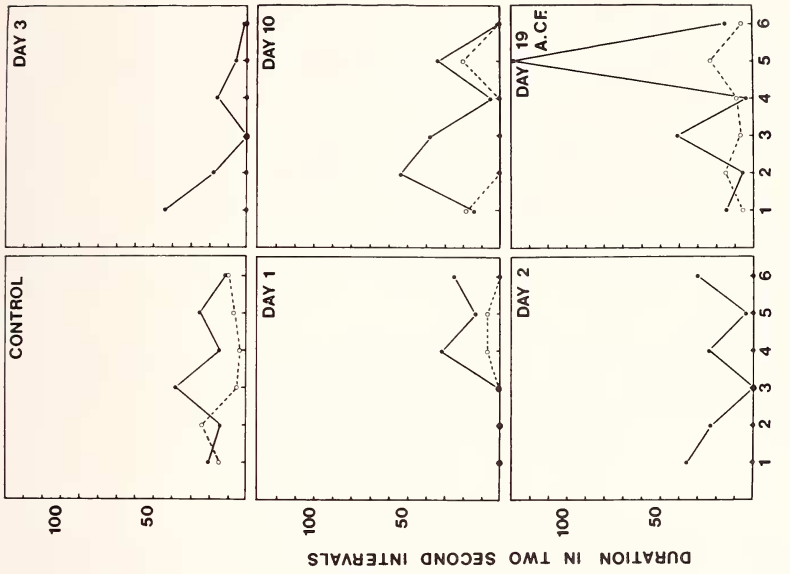

Fig. 2. General motor activity of ♂ 447 (– – –) and ♂ 525 (——) during the control situation (×), on the days 1, 2, 3, and 10 of confrontation and on day 19 after its end

Fig. 3. Comfort activities of ♂ 447 (– – –) and ♂ 525 (——) during the control situation (×), on the days 1, 2, 3, and 10 of confrontation and on day 19 after its end

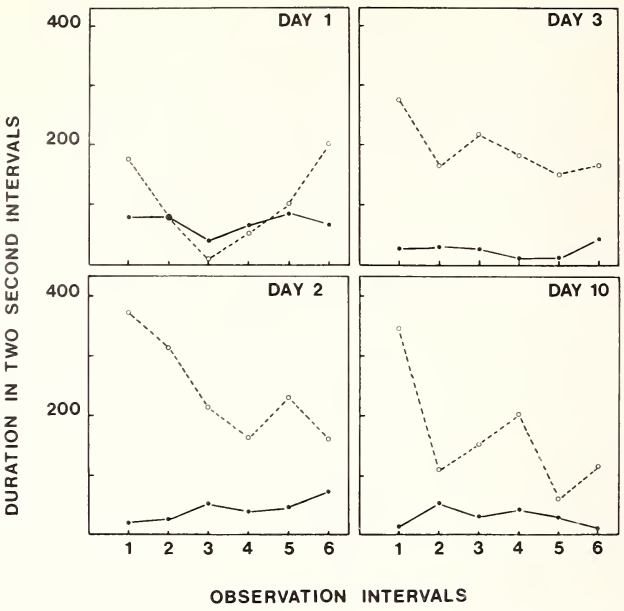

Fig. 4. Looking at the conspecific antagonist during the days 1, 2, 3, and 10 of confrontation. ♂ 447 (– – –), ♂ 525 (——)

his comfort behavior during and after confrontation (Fig. 3). ♂ 447 decreased his comfort activities significantly on days 2 and 3 ($p < 0.05$, two tailed).

Looking at the conspecific antagonist: There was a highly significant difference ($p < 0.0001$, t-Welsh-Test) between both animals (♂ 447 > ♂ 525) in the duration of looking at the other animal and observing his movements (Fig. 4).

The significant decreases in marking activities, GMA, comfort behavior and the higher rate of optical controlling the opponent are the first quantitative data describing behavioral changes in subordinate male tree shrews under chronic social stress.

The behavioral analysis of the confrontation experiment of former dominant tree shrews demonstrates, that dominance in these animals is of a relative quality, which depends on the individual strength and is not connected to the possession of a territory. Up to now, it has not been possible to define the parameter strength, which leads to a dominant position. Scent marking obviously plays a crucial role in this process, which is shown by the significant increase of sternal and abdominal marking of the later winner on day 1 of confrontation, and by his high frequencies of abdominal marking on the following two days. Although the subordinate male showed an increase in both sternal and abdominal marking on confrontation day 1, the marking behavior disappeared over the following days and returned to control levels when he was back in his home cage. In former experiments (Aue and Fuchs 1986), in which ♂ 525 and ♂ 447 were confrontated with another male and were both dominant, they exhibited significant increases of sternal and abdominal marking during the first days of confrontation. The relationship between individual strength and scent marking, as well as the influence of this behavior in gaining and maintaining dominant positions, will be investigated in further experiments.

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Die Haselmaus *(Muscardinus avellanarius)* in Nestern freibrütender Singvögel

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In der Paläarktis beziehen eine Reihe von Kleinsäugern regelmäßig Vogelnester, um sie als Unterschlupf, zur Fortpflanzung oder als Vorratslager zu benutzen. Das geschieht bevorzugt bei Nestern, die sich in Nisthöhlen befinden, wird vor allem bei der Kontrolle von künstlichen Nistkästen beobachtet, und ist im einzelnen regelmäßig für alle vier Bilche (Siebenschläfer, *Glis glis,* Gartenschläfer, *Eliomys quercinus,* Baumschläfer, *Dryomys nitedula,* Haselmaus, *Muscardinus avellanarius*) sowie für die Gelbhalsmaus *(Apodemus flavicollis)* und vereinzelt auch für Waldmaus *(Apodemus sylvaticus)* und Rötelmaus *(Clethrionomys glareolus)* beschrieben (Löhrl 1973). Wohl weit seltener (allerdings auch weniger augenfällig) werden auch Nester freibrütender (nicht in Höhlen brütender) Vögel verwendet, so z.B. das Nest des Cistensängers *(Cisticola juncidis)* von der Zwergmaus (*Micromys minutus,* Chartier 1984).

Von der Haselmaus ist bekannt, daß sie vor allem leere Vogelnisthöhlen bezieht, die sie lediglich als Unterschlupf verwendet. Nur selten übernimmt sie Meisennester, unter deren Moos sie sich einen Hohlraum schafft. Dabei frißt sie gelegentlich auch Vogeleier an (Löhrl 1973).

Bei systematischer Suche von Vogelnestern für brutbiologische Studien (Berthold und Querner 1984) entdeckten wir 1985 in drei Fällen Haselmäuse in Nestern freibrütender Singvogelarten – dabei sogar im Schilfgürtel des Bodensees –, über die wir hier berichten.

Fall 1: Anfang Juli saß eine Haselmaus im Schilfgürtel des Bodensees (Untersee, Höri) im Nest eines Teichrohrsängers *(Acrocephalus scirpaceus),* dessen Eier sie möglicherweise verzehrt hatte, da das Nest frische Eischalenreste enthielt. Das Nest stand unweit vom Ufer, aber über etwa 30 cm hohem Wasser. Da sich in der Nähe des Nestes weitere besetzte Teichrohrsängernester befanden, die nicht geplündert werden sollten, haben wir die Haselmaus in einen mehrere Kilometer entfernten Wald verfrachtet, von wo aus sie zumindest nicht in kurzer Zeit zurückkehren konnte.

Fall 2: Am 8. Juli fanden wir eine zweite Haselmaus in einem Teichrohrsängernest (Gebiet wie bei Fall 1, aber etwa 150 m vom ersten Fundort entfernt). Das Nest stand

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